Carrier®
HEATING & COOLING

58GFA
Upflow Induced-Combustion Furnaces

Installation, Start-Up, and Operating Instructions
Sizes 065-150, Series 130

NOTE: Read the entire instruction manual before starting the installation.

This symbol → indicates a change since the last issue.

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SAFETY CONSIDERATIONS

Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment.

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in the literature, on tags, and on labels attached to or shipped with the unit and other safety precautions that may apply.

Follow all safety codes. In the United States, follow all safety codes including the National Fuel Gas Code NFPA No. 54-1992/ANSI Z223.1-1992 (NFGC). In Canada, refer to the current edition of the National Standard of Canada CAN/CGA-B149.1- and .2-M95 Natural Gas and Propane Gas Installation Codes (NSCNGPIC). Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

Recognize safety information. This is the safety-alert symbol ⚠ . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal word DANGER, WARNING, or CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies a hazard which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** result in minor personal injury or product and property damage.

NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

INTRODUCTION

→ The model 58GFA Series 130 Furnaces are available in sizes 65,000 through 150,000 Btuh input capacities.

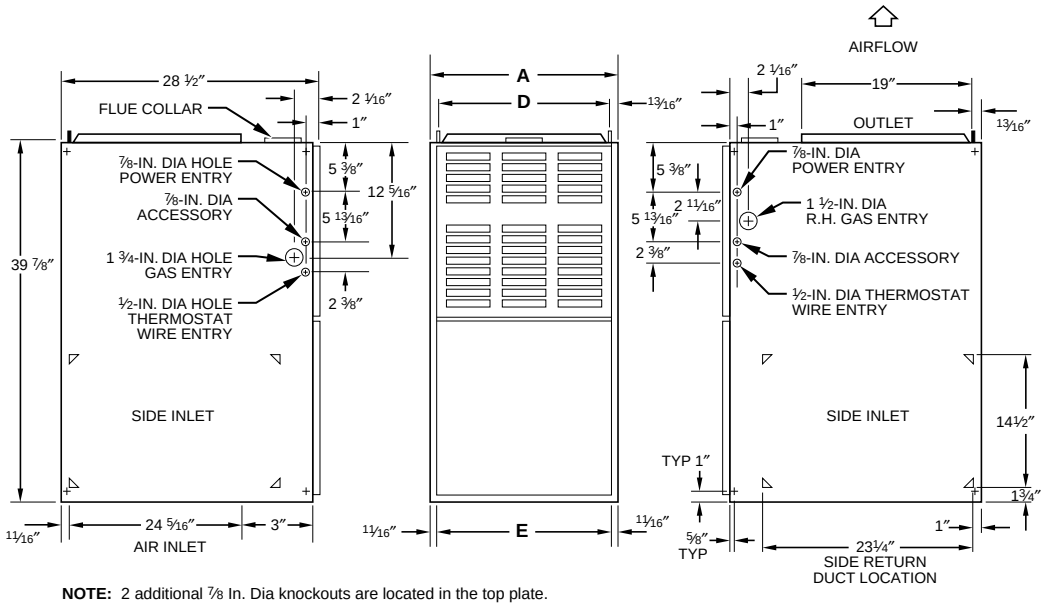
The design of the upflow gas-fired furnace is A.G.A./C.G.A. certified for natural and propane gas and for installation on combustible flooring, in alcoves, attics, basements, closets, or utility rooms. The design of this furnace line is **not** A.G.A./C.G.A. certified for installation in mobile homes, recreation vehicles, or outdoors.

Table 1—Minimum Clearances From Combustible Materials (In.)

UNIT SIZE		065	086-150
Sides	Single-Wall Vent	1	0
	Type B-1 Double-Wall Vent	0	0
Back		0	0
Top of Plenum		1	1
Vent	Single-Wall Vent	6	6
	Type B-1 Double-Wall Vent	1	1
Front	Single-Wall Vent	6	6
	Type B-1 Double-Wall Vent	3	3
	Service	30	30

NOTES:
1. Provide 30-in. front clearance for servicing. An open door in front of the furnace can meet this requirement.
2. A minimum clearance of 3 in. must be provided in front of the furnace for combustion air and proper operation.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.



NOTE: 2 additional 7/8 In. Dia knockouts are located in the top plate.

NOTES: Minimum return-air opening at furnace:
1. For 800 CFM–16-In. round or 14½ x 12-In. rectangle.
2. For 1200 CFM–20-In. round or 14½ x 19½-In. rectangle.
3. For 1600 CFM–22-In. round or 14½ x 23¼-In. rectangle.
4. For airflow requirements above 1800 CFM, use both side inlets, a combination of 1 side inlet and the bottom, or the bottom only.

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Table 2—Dimensions (In.)

UNIT SIZE	A	D	E	VENT CONN	SHIP. WT
065-08	14-3/16	12-9/16	12-11/16	4	126
065-12	14-3/16	12-9/16	12-11/16	4	128
086-14	17-1/2	15-7/8	16	4	143
086-16	21	19-3/8	19-1/2	4	147
105-12	17-1/2	15-7/8	16	4	153
105-16	21	19-3/8	19-1/2	4	159
105-22	24-1/2	22-7/8	23	4	176
130-16	21	19-3/8	19-1/2	5	171
130-20	24-1/2	22-7/8	23	5	186
150-20	24-1/2	22-7/8	23	5	196

Fig. 1—Dimensional Drawing

Before installing the furnace, refer to the current edition of the NFGC. Canadian installations must be installed in accordance with NSCNGPIC and all authorities having jurisdiction. For further information, the National Fuel Gas Code is available from National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269, American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209, or from Literature Distribution.

Installation must conform to the regulations of the serving gas supplier and the local building, heating, and plumbing codes in effect in the area in which the installation is made, or in the absence of local codes with the requirements of the NFGC.

⚠ CAUTION

Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, and unit sizing. Improper installation or misapplication of the furnace can require excessive servicing or cause premature component failure.

This furnace is designed for a minimum continuous return-air temperature of 60°F db or an intermittent operation down to 55°F db such as when used with a night setback thermostat. Return-air temperature must not exceed a maximum of 85°F db.

⚠ WARNING

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product. Failure to follow this warning can cause electrical shock, fire, personal injury, or death.

For accessory installation details, refer to the applicable instruction literature.

NOTE: Remove all shipping brackets and materials before operating the furnace.

Step 1—Location

GENERAL

⚠ CAUTION

Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met, in addition to all local codes and ordinances.

⚠ CAUTION

Do not use this furnace during construction when adhesives, sealers, and/or new carpets are being installed. If the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine when burned with combustion air form acids which will cause corrosion of the heat exchangers and metal vent system. Some of these compounds are found in paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in the construction process.

Excessive exposure to contaminated combustion air will result in safety and performance related problems.

This furnace must be installed so the electrical components are protected from water. Locate the furnace close to the chimney/vent and as near the center of the air distribution system as possible. The furnace should be installed level.

When a furnace is installed so that the supply ducts carry air to areas outside the space containing the furnace, the return air must also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

Provide ample space for servicing and cleaning. Always comply with the minimum fire protection clearances shown on the unit rating plate. This furnace shall not be installed directly on carpeting, tile, or any combustible material other than wood flooring.

LOCATION RELATIVE TO COOLING EQUIPMENT — The cooling coil must be installed parallel with or on the downstream side of the furnace to avoid condensation in the heat exchangers. When installed parallel with a furnace, dampers or other means used to control the flow of air must prevent chilled air from entering the unit. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

HAZARDOUS LOCATIONS — When the furnace is installed in a residential garage, it must be installed so that the burners and ignition source are located at least 18 in. above the floor. The furnace should be protected from physical damage by vehicles. When a furnace is installed in public garages, airplane hangars, or other buildings having hazardous atmospheres, the unit must be installed in accordance with the recommended good practice requirements of the National Fire Protection Association, Inc.

Step 2—Air for Combustion and Ventilation

Provisions for adequate combustion and ventilation air must be provided in accordance with Section 5.3, Air for Combustion and Ventilation, of the NFGC or applicable provisions of the local building codes.

Canadian installations must be in accordance with NSCNGPIC.

⚠ CAUTION

Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

All fuel-burning equipment must be supplied with air for combustion of the fuel. Sufficient air MUST be provided to ensure there will not be a negative pressure in the equipment room or space. In addition, a positive seal MUST be made between the furnace cabinet and the return-air duct to prevent air from being pulled from the burner area and draft safeguard opening.

⚠ CAUTION

The operation of exhaust fans, kitchen ventilation fans, clothes dryers, or fireplaces could create a NEGATIVE PRESSURE condition at the furnace. Makeup air MUST be provided for the ventilation devices, in addition to that required by the furnace.

Combustion air requirements are determined by whether the furnace is in an UNCONFINED or CONFINED space.

UNCONFINED SPACE — An unconfined space must have at least 50 cu ft for each 1000 Btuh of input for all the appliances (such as furnaces, clothes dryer, water heaters, etc.) in the space.

For Example:

58GFA FURNACE INPUT BTUH	MINIMUM SQ FT WITH 7-1/2 FT CEILING
63,000	420
84,000	560
105,000	700
126,000	840
147,000	980

If the unconfined space is of unusually tight construction, air for combustion and ventilation MUST come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be sized the same as for a confined space. A minimum opening with a total of not less than 1 sq in. per 5000 Btuh of total input rating for all equipment must be provided. Return air must not be taken from the room unless an equal or greater amount of air is supplied to the room.

CONFINED SPACE — A confined space is one whose volume is less than 50 cu ft per 1000 Btuh of the total output rating for all appliances installed in that space. A confined space MUST have 2 permanent openings, 1 within 12 in. of the ceiling, and the other within 12 in. of the floor. (See Fig. 2.)

NOTE: In determining the free area of an opening, the blocking effect of the louvers, grilles, and screens must be considered. If the free area of a louver or grille design is unknown, it may be assumed that wood louvers have a 20 percent free area and metal louvers or grilles have a 60 percent free area. Screens, when used, must not be smaller than 1/4-in. mesh. Louvers and grilles must be constructed so they cannot be closed.

The size of the openings depends upon whether the air comes from inside or outside of the structure.

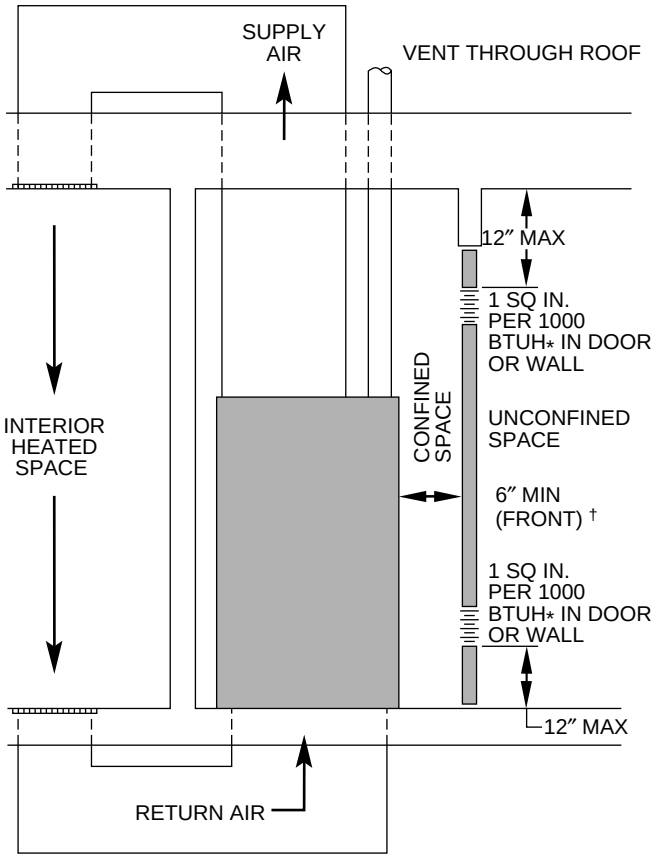
1. All air from inside the structure:

   Each opening MUST have at least 1 sq in. of free area per 1000 Btuh of the total input for all equipment within the confined space, but not less than 100 sq in. per opening. (See Fig. 2.)

For Example:

58GFA FURNACE INPUT BTUH	FREE AREA PER OPENING (SQ IN.)
63,000	100
84,000	100
105,000	105
126,000	126
147,000	147

If the building is constructed unusually tight, a permanent opening directly communicating with the outdoors should be provided. This opening shall have a minimum free area of 1 sq in. per 5000 Btuh of total input rating for all equipment in the enclosure.



* Minimum opening size is 100 square in. with minimum dimensions of 3-In.

† Minimum of 3-In. when type-B1 vent is used.

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Fig. 2—Air for Combustion and Ventilation (Inside Air)

If the furnace is installed on a raised platform to provide a return-air plenum, and return air is taken directly from the hallway or space adjacent to the furnace, all air for combustion must come from outdoors.

2. All air from outside the structure:

   a. If combustion air is taken from outdoors through vertical ducts, the openings and ducts MUST have at least 1 sq in. of free area per 4000 Btuh of the total input for all equipment within the confined space. (See Fig. 3.)

For Example:

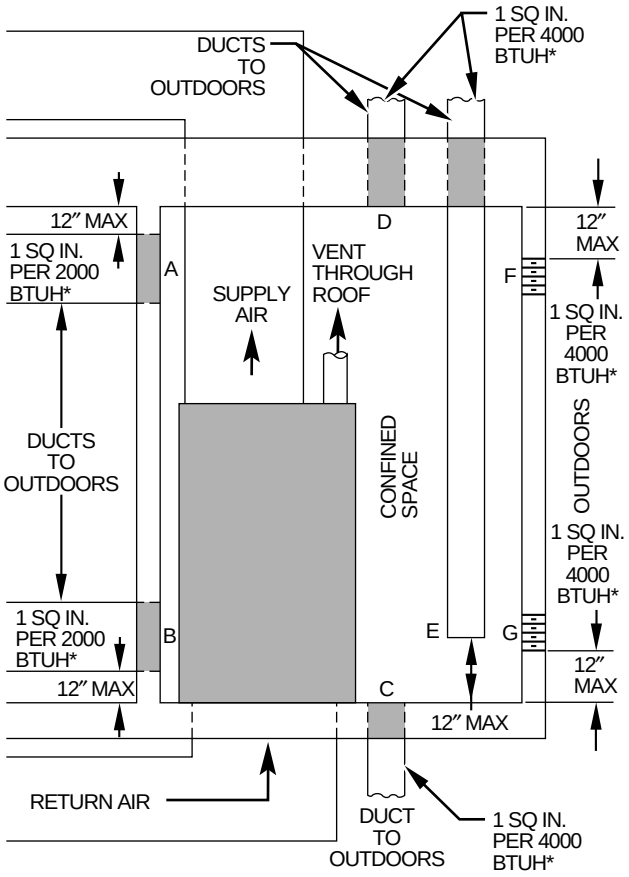
58GFA FURNACE INPUT BTUH	FREE AREA PER OPENING (SQ IN.)	ROUND PIPE (IN. DIA)
63,000	16.0	5
84,000	21.0	6
105,000	26.5	6
126,000	31.5	7
147,000	37.0	7

   b. If combustion air is taken from the outdoors through horizontal ducts, the openings and ducts MUST have at least 1 sq in. of free area per 2000 Btuh of the total input for all equipment within the confined space.

For Example:

58GFA FURNACE INPUT BTUH	FREE AREA PER OPENING (SQ IN.)	ROUND PIPE (IN. DIA)
63,000	31.5	7
84,000	42.0	8
105,000	52.5	9
126,000	63.0	9
147,000	73.5	10

When ducts are used, they must be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular ducts must not be less than 3 in. (See Fig. 3.)



*Minimum dimensions of 3-In.

NOTE: Use any of the following combinations of openings:
A & B C & D D & E F & G

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Fig. 3—Air for Combustion and Ventilation (Outside Air)

⚠ WARNING

Do not install the furnace on its back; safety control operation will be adversely affected. Never connect return-air ducts to the back of the furnace. Failure to follow this warning can cause a fire, personal injury, or death.

Step 3—Filter Arrangement

The factory-supplied filter(s) is shipped in the blower compartment. Determine location for the filter and move filter retaining hardware, if necessary, before attaching the return-air duct. After the return-air duct has been connected to the furnace, install the filter(s) inside the furnace blower compartment. See Fig. 4 for side return application and Fig. 5 for bottom return application.

A bottom closure panel is factory installed in the bottom of the furnace. When bottom return inlet is desired, remove and discard the enclosure panel.

Filter retaining brackets, supports, and retainers are factory assembled and shipped installed for side return application, with 1 set of all required hardware provided. (See Fig. 4.) For bottom return applications, remove the brackets (front and back) and supports from each side. The back bracket(s) are installed in the rear of the furnace casing. Dimples are provided to mark mounting screw locations.

The front bracket(s) are installed on the bottom front plate as shown in Fig. 5, once the bottom enclosure has been removed. Rotate filter supports 180° so filter will rest on support, and reinstall. (Do not reinstall in 17-1/2 in. casing.) Install the filter retaining rod (small U-shaped end) in the rear bracket, and the front of the filter retainer rod as shown in Fig. 5. Two sets of hardware are needed for furnaces in 24-1/2 in. casings using 1 filter for bottom return. All hardware is provided for filter installation.

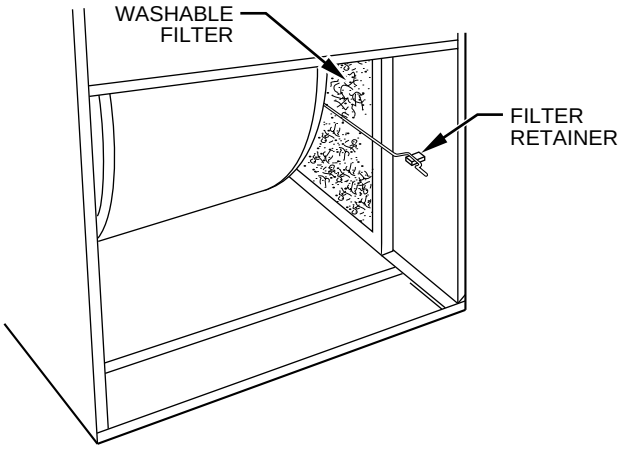

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Fig. 4—Side Filter Arrangement

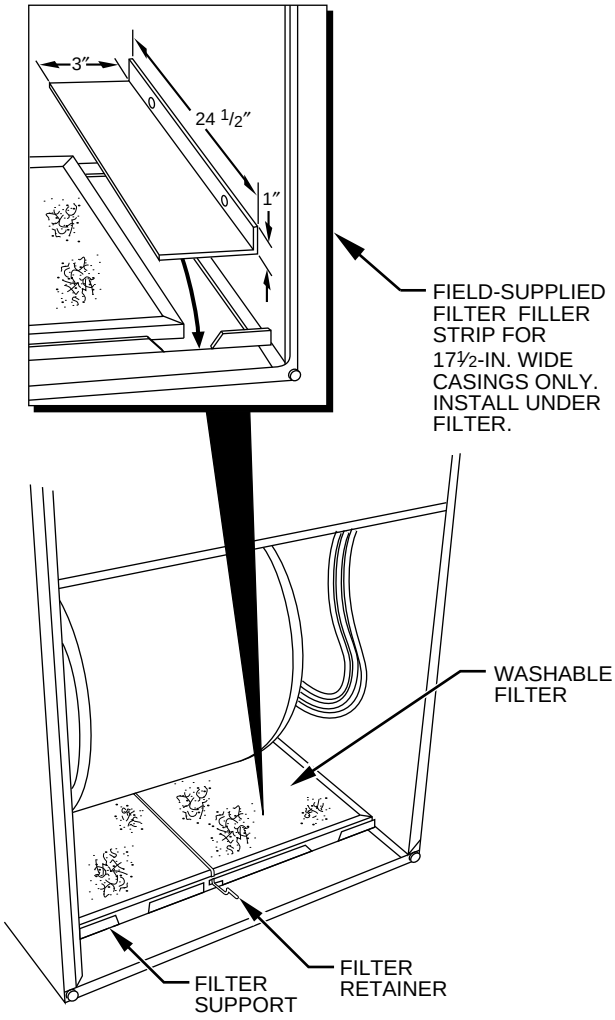

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Fig. 5—Bottom Filter Arrangement

⚠ WARNING

Never operate unit without a filter or with filter access door removed. Failure to follow this warning can cause fire, personal injury, or death.

Table 3—Filter Information (In.)

FURNACE CASING WIDTH	FILTER QUANTITY AND SIZE*		FILTER TYPE
	Side Return	Bottom Return	
14-3/16	(1) 16 X 25 X 1†	(1) 14 X 25 X 1	Cleanable
17-1/2	(1) 16 X 25 X 1†	(1) 16 X 25 X 1	Cleanable
21	(1) 16 X 25 X 1	(1) 20 X 25 X 1†	Cleanable
24-1/2	(2) 16 X 25 X 1†	(1) 24 X 25 X 1	Cleanable

* Filter can be field modified by cutting to the desired size. Alternate sizes can be ordered from your distributor or dealer.
† Factory provided with the furnace.

Step 4—Leveling Legs (If Required)

When the furnace is used with side inlet(s) and leveling legs are required, refer to Fig. 6, and install field-supplied, corrosion-resistant 5/16-in. machine bolts and nuts.

NOTE: The maximum length of the bolt should not exceed 1-1/2 in.

1. Lay furnace on its back. Locate and drill 5/16-in. diameter hole in each bottom corner of furnace as shown in Fig. 6.
2. Install nut on bolt and install bolt and nut in hole. (Install flat washer if desired.)

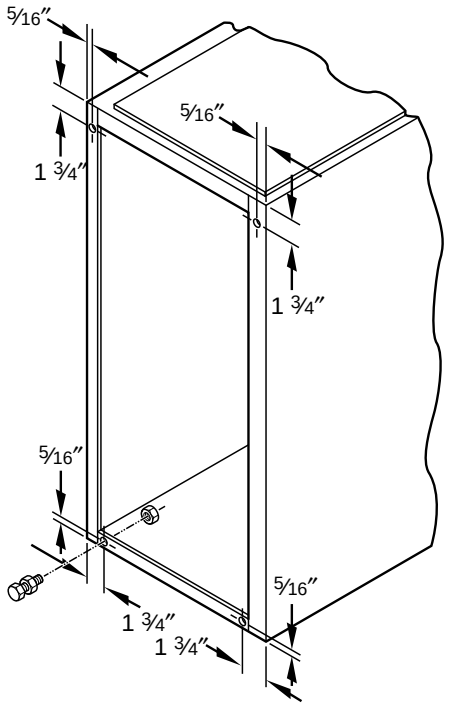

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Fig. 6—Leveling Leg Installation

3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height, and tighten inside nut to secure arrangement.

Step 5—Gas Piping

Gas piping must be installed in accordance with national and local codes. Refer to the current edition of the NFGC. Canadian installations must be installed in accordance with NSCNGPIC and all authorities having jurisdiction.

The gas supply line should be a separate line running directly from the gas meter to the furnace, if possible. Refer to Table 4 for the recommended gas pipe size. Risers must be used to connect to the furnace and the meter.

Table 4—Maximum Capacity of Pipe*

NOMINAL IRON PIPE SIZE (IN.)	INTERNAL DIAMETER (IN.)	LENGTH OF PIPE (FT)				
		10	20	30	40	50
1/2	0.622	175	120	97	82	73
3/4	0.824	360	250	200	170	151
1	1.049	680	465	375	320	285
1-1/4	1.380	1400	950	770	660	580
1-1/2	1.610	2100	1460	1180	990	900

* Cubic ft of gas per hr for gas pressures of 0.5 psig (14-in. wc) or less, and a pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas). Ref: Table C-2 NFPA 54-1992.

⚠ CAUTION

If a flexible connector is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 2 in. outside the furnace casing.

Piping should be pressure tested in accordance with local and national plumbing and gas codes before the furnace has been attached. If the pressure exceeds 0.5 psig (14-in. wc), the gas supply pipe must be disconnected from the furnace and capped before the pressure test. If the test pressure is equal to or less than 0.5 psig (14-in. wc), close the manual shut-off valve located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing. After all connections have been made, purge the lines and check for leakage with regulated gas supply pressure.

Install a sediment trap in the riser leading to the furnace. The trap can be installed by connecting a tee to the riser leading from the furnace. Connect a capped nipple into the lower end of the tee. The capped nipple should extend below the level of the gas controls. (See Fig. 7.)

Apply joint compound (pipe dope) sparingly and only to the male threads of each joint. The compound must be resistant to the action of propane gas.

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition for the purpose of checking leakage. Use a soap-and-water solution to check for leakage. Failure to follow this warning can cause fire, explosion, personal injury, or death.

Install accessible manual shut-off valve upstream of the furnace gas controls and within 72 in. of the furnace. A 1/8-in. NPT plugged tapping, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shut-off valve. Place ground joint union between the gas control manifold and the manual shut-off valve.

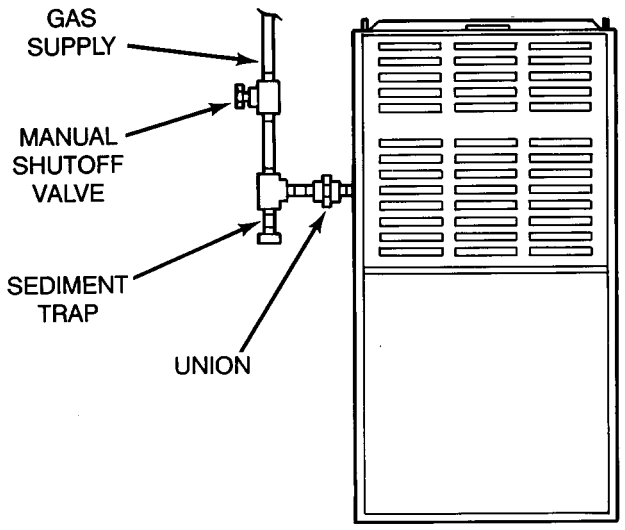

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Fig. 7—Typical Gas Pipe Arrangement

⚠ WARNING

Use the proper length of pipes to avoid stress on the gas control manifold. Failure to follow this warning can cause a gas leak resulting in fire, explosion, personal injury, or death.

⚠ CAUTION

Connect the gas pipe to the furnace using a backup wrench to avoid damaging gas controls.

Step 6— Electrical Connections

115-V WIRING — Refer to the unit rating plate or Table 5 for equipment electrical requirements. The control system requires an earth ground for proper operation.

⚠ CAUTION

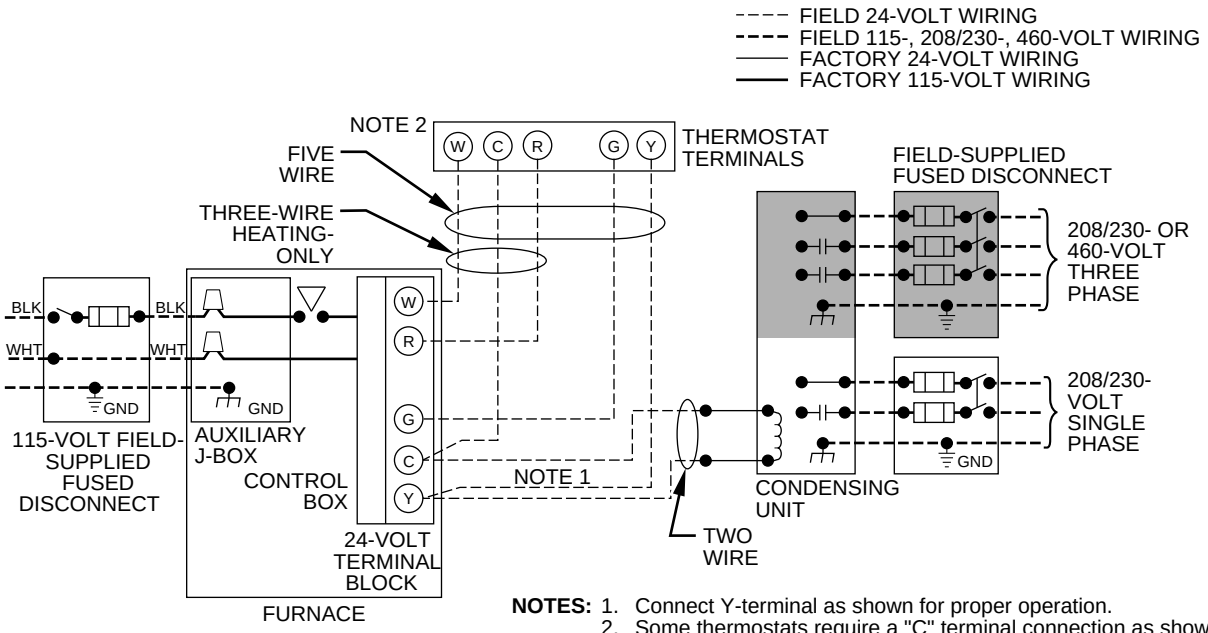
Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire.

Make all electrical connections in accordance with the National Electrical Code ANSI/NFPA 70-1990 and local codes or ordinances that might apply. For Canadian installations, all electrical connections must be made in accordance with Canadian Electrical Code CSA C22.1 or authorities having jurisdiction.

⚠ WARNING

The cabinet MUST have an uninterrupted or unbroken ground according to National Electrical Code ANSI/NFPA 70-1990 and Canadian Electrical Code CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground.

The auxiliary junction box can be moved to the right-hand side of the furnace when a right side power supply is desired. Remove the 2 screws holding the auxiliary junction box. Mount the junction box on the right-hand side of the furnace (holes have been predrilled in casing). The blower door interlock switch must also be moved to the right-hand side of the furnace due to the length of the wiring harness. When moved, tuck the wiring harness behind the clip provided to keep extra wire lengths out of the way.



NOTES: 1. Connect Y-terminal as shown for proper operation.
2. Some thermostats require a "C" terminal connection as shown.
3. If any of the original wire, as supplied, must be replaced, use same type or equivalent wire.

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→ **Table 5—Electrical Data**

UNIT SIZE	VOLTS—HERTZ—PHASE	OPERATING VOLTAGE RANGE		MAX UNIT AMPS	MIN WIRE GAGE	MAX WIRE LENGTH (FT)‡	MAX FUSE OR HACR-TYPE CKT BKR AMPS†
		Max*	Min*				
065-08	115—60—1	127	104	7.1	14	41	15
065-12	115—60—1	127	104	8.7	14	34	15
086-14	115—60—1	127	104	9.0	14	33	15
086-16	115—60—1	127	104	10.4	14	28	15
105-12	115—60—1	127	104	8.0	14	37	15
105-16	115—60—1	127	104	10.1	14	29	15
105-22	115—60—1	127	104	14.4	12	33	20
130-16	115—60—1	127	104	10.1	14	29	15
130-20	115—60—1	127	104	13.3	12	36	20
150-20	115—60—1	127	104	13.7	12	35	20

* Permissible limits of the voltage range at which the unit will operate satisfactorily.
† Time-delay fuse is recommended.
‡ Length shown is as measured 1 way along wire path between unit and service panel for maximum 2 percent voltage drop.

Fig. 8—Heating and Cooling Application Wiring Diagram

24-V WIRING — Make field 24-v connections at the 24-v terminal strip. (See Fig. 8 and 9.) Connect terminal Y as shown in Fig. 8 for proper cooling operation. Use only AWG No. 18, color-coded copper thermostat wire.

The 24-v circuit contains an automotive-type, 3-amp fuse located on the main control board. Any direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use ONLY a 3-amp fuse of identical size.

→ ACCESSORY

Electronic air cleaner (EAC)

Two terminals (EAC-1 and EAC-2) are provided for EAC connection. The terminals are energized with 115-v, 1-amp maximum during blower motor operation.

Step 7—Venting

Refer to the enclosed Installation Instructions, GAMA Venting Tables for Category I Furnaces and venting tables for Category I Fan-Assisted Furnaces. The horizontal portion of the venting system shall maintain a minimum of 1/4-in. upward slope per linear ft and it shall be rigidly supported every 5 ft or less with hangers or straps to ensure that there will be no movement after installation.

Step 8—Start-Up, Adjustment, and Safety Check

GENERAL — The furnace must have a 115-v power supply properly connected and grounded. Thermostat wire connections at R, W, C, and Y must be made at the 24-v terminal block on the control board. The gas service pressure must not exceed 0.5 psig (14-in. wc), but must be no less than 0.16 psig (4.5-in. wc).

⚠ CAUTION

This furnace is equipped with a fuse link in the gas control area. The fuse link will open and shut off power to the gas valve if a flame rollout or overheating condition occurs in the gas control area. DO NOT bypass the fuse link. Call your service dealer to correct inadequate combustion-air supply problem and replace fuse link.

Before operating the furnace, check each manual reset switch for continuity. If necessary, press the button to reset the switch.

The blower compartment door must be in place to complete the 115-v circuit to the furnace.

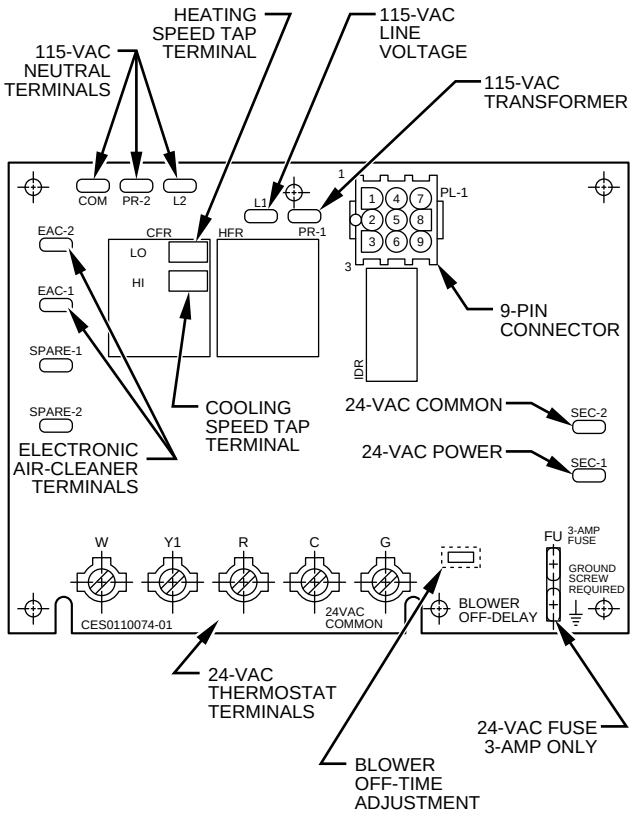
SEQUENCE OF OPERATION — Using the schematic diagram show in Fig. 10, follow the sequence of operation through the different modes.

NOTE: When the blower door is in place, 115v is supplied through blower door interlock switch ILK to heating fan relay HFR, induced draft relay IDR, and transformer TRAN. Transformer TRAN energizes the safety circuit containing fuse link FL and limit switch LS to energize R.

The furnace pilot must be lit so the thermocouple energizes the thermal magnet circuit of gas valve GV, which permits gas flow to the remaining portion of the valve.

1. Heating mode
   a. When the wall thermostat "calls for heat" the R-W circuit closes. This closed circuit supplies power to the 24-v safety circuit containing automatic reset limit switch LS and fuse link FL.
   b. The inducer-motor relay coil IDR is energized. Inducer motor relay contacts in the 115-v circuit close, starting inducer motor IDM. Simultaneously, another set of contacts in inducer-motor relay IDR close in the 24-v circuit and lock-in until the R-W circuit or safety opens.
   c. As inducer motor IDM comes up to speed, pressure switch PRS actuates and supplies power through manual reset draft safeguard switch DSS. Both solenoid coils in gas valve GV are energized, causing the valve to open and permitting gas flow to the main burners, where it is ignited by the pilot.
   d. Simultaneously, solid-state time-delay circuit in the blower control center is energized. Approximately 45 sec after the R-W circuit is closed, heating fan relay coil HFR is energized, closing the 115-v contacts of heating fan relay HFR, and starting blower motor BLWM on heating speed. EAC terminals energize with 115v when the blower is operating on either heating or cooling speed.
   e. When the thermostat is satisfied, the R-W circuit is broken, de-energizing both solenoid coils of gas valve GV and the solid-state time-delay circuit for the heating fan relay HFR. The gas flow to the main burners immediately stops. Approximately 120 sec (or 180 sec depending on the blower off time selected) after main burners are extinguished, heating fan relay HFR is de-energized and blower motor BLWM stops. The blower off delay can be permanently changed to 180 sec by cutting the resistor. (See Fig. 9.)
   f. If the pilot flame is extinguished, the thermocouple no longer energizes the thermal magnet circuit of gas valve GV. Gas flow to the pilot and main burners ceases until the pilot is manually relit.

NOTE: When gas valve GV is energized, R-W circuit is closed. After a power interruption, the gas valve closes within 7 sec and the furnace skips the blower on delay and immediately starts the blower.



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→ **Fig. 9—Control Center**

2. Cooling mode

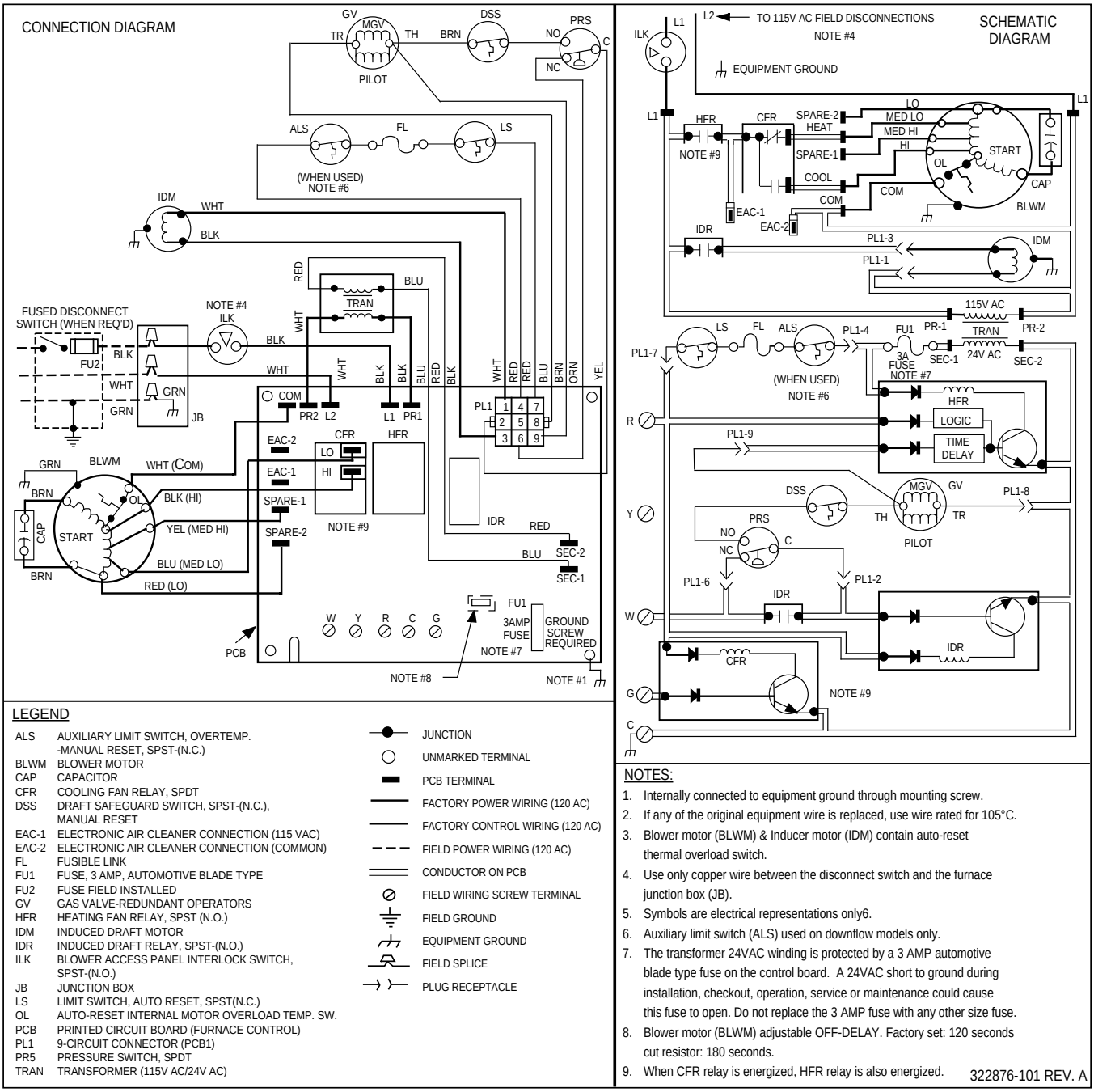
   When the wall thermostat "calls for cooling" the R, G, and Y circuits close. Simultaneously, the R-Y circuit starts the outdoor condensing unit, the R-G circuit energizes cooling relay coil CFR, and heating fan relay coil HFR. The normally open contact of heating fan relay HFR and the normally open contact of cooling relay CFR closes, energizing the cooling speed of blower motor BLWM. The EAC terminals are energized with 115v when the blower is operating on either heating or cooling speed.

3. Continuous blower mode

   When the R-G circuit is made, the blower motor operates on cooling speed. During a "call for heat", the blower stops, allowing the furnace heat exchangers to heat up more quickly. When the blower motor comes back on it runs on heating speed. The blower reverts to continuous operation after the heating cycle blower off delay is completed.

START-UP PROCEDURES — Check to be sure that all connections have been properly made, then light the pilot using the procedure outlined on the lighting/operation instructions label attached to the furnace. However, when lighting the pilot for the first time, perform the following additional steps:

1. Purge gas lines after all connections have been made and check for leaks.


CONNECTION DIAGRAM
SCHEMATIC DIAGRAM
TO 115V AC FIELD DISCONNECTIONS
NOTE #4
EQUIPMENT GROUND
FUSED DISCONNECT SWITCH (WHEN REQ'D)
(WHEN USED) NOTE #6
NOTE #7
NOTE #8
NOTE #9
NOTE #1
GROUND SCREW REQUIRED
3AMP FUSE
24V AC
115V AC
LEGEND
ALS AUXILIARY LIMIT SWITCH, OVERTEMP. -MANUAL RESET, SPST-(N.C.)
BLWM BLOWER MOTOR
CAP CAPACITOR
CFR COOLING FAN RELAY, SPDT
DSS DRAFT SAFEGUARD SWITCH, SPST-(N.C.), MANUAL RESET
EAC-1 ELECTRONIC AIR CLEANER CONNECTION (115 VAC)
EAC-2 ELECTRONIC AIR CLEANER CONNECTION (COMMON)
FL FUSIBLE LINK
FU1 FUSE, 3 AMP, AUTOMOTIVE BLADE TYPE
FU2 FUSE FIELD INSTALLED
GV GAS VALVE-REDUNDANT OPERATORS
HFR HEATING FAN RELAY, SPST (N.O.)
IDM INDUCED DRAFT MOTOR
IDR INDUCED DRAFT RELAY, SPST-(N.O.)
ILK BLOWER ACCESS PANEL INTERLOCK SWITCH, SPST-(N.O.)
JB JUNCTION BOX
LS LIMIT SWITCH, AUTO RESET, SPST(N.C.)
OL AUTO-RESET INTERNAL MOTOR OVERLOAD TEMP. SW.
PCB PRINTED CIRCUIT BOARD (FURNACE CONTROL)
PL1 9-CIRCUIT CONNECTOR (PCB1)
PR5 PRESSURE SWITCH, SPDT
TRAN TRANSFORMER (115V AC/24V AC)
JUNCTION
UNMARKED TERMINAL
PCB TERMINAL
FACTORY POWER WIRING (120 AC)
FACTORY CONTROL WIRING (120 AC)
FIELD POWER WIRING (120 AC)
CONDUCTOR ON PCB
FIELD WIRING SCREW TERMINAL
FIELD GROUND
EQUIPMENT GROUND
FIELD SPLICE
PLUG RECEPTACLE
NOTES:
1. Internally connected to equipment ground through mounting screw.
2. If any of the original equipment wire is replaced, use wire rated for 105°C.
3. Blower motor (BLWM) & Inducer motor (IDM) contain auto-reset thermal overload switch.
4. Use only copper wire between the disconnect switch and the furnace junction box (JB).
5. Symbols are electrical representations only6.
6. Auxiliary limit switch (ALS) used on downflow models only.
7. The transformer 24VAC winding is protected by a 3 AMP automotive blade type fuse on the control board. A 24VAC short to ground during installation, checkout, operation, service or maintenance could cause this fuse to open. Do not replace the 3 AMP fuse with any other size fuse.
8. Blower motor (BLWM) adjustable OFF-DELAY. Factory set: 120 seconds cut resistor: 180 seconds.
9. When CFR relay is energized, HFR relay is also energized.
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→ **Fig. 10—Unit Wiring Diagram**

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame or other sources of ignition for the purpose of checking leakage. Use a soap-and-water solution to check for leakage. Failure to follow this warning can cause fire, explosion, personal injury, or death.

2. Allow 5 minutes to elapse after purging gas lines, then light pilot in accordance with lighting/operating instructions label on the furnace.

   The pilot flame should be soft blue in color and surround 3/8 to 1/2 in. of the thermocouple element tip. The flame must never come in contact with any other part of the thermocouple or its lead wire. The flame should extend above the carryover part of the burner and merge with the carryover flame. If the pilot flame requires adjustment:

   a. Locate adjustment screw on top of the main gas valve right next to the pilot tube. (See Fig. 11.)

   b. Remove capscrew and turn adjustment screw clockwise (in) to decrease pilot gas flow and counterclockwise (out) to increase pilot gas flow.

   c. When proper adjustment is obtained, replace capscrew.

3. Allow 5 minutes for the pilot to establish a draft before operating furnace.

Table 6—Model 58GFA Orifice Size and Manifold Pressure for Correct Input Rate (Tabulated Data Based on Altitude Up to 2000 Ft and 21,000 Btuh Per Burner)

GAS HEAT VALUE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS																			
	0.54		0.56		0.58		0.60		0.62		0.64		0.66		0.68		0.70		0.72	
	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.	Orf No.	Mnfld Press.
860	43	3.8	42	3.2	42	3.3	42	3.5	41	3.2	41	3.3	40	3.2	40	3.3	40	3.3	39	3.2
	—	—	—	—	—	—	—	—	42	3.6	42	3.7	41	3.4	41	3.5	41	3.6	40	3.4
	—	—	-	—	—	—	—	—	—	—	—	—	42	3.8	—	—	—	—	41	3.7
875	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4	40	3.2	40	3.3
	—	—	—	—	—	—	—	—	—	—	42	3.6	42	3.7	42	3.8	41	3.5	41	3.6
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
890	43	3.5	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4	40	3.2
	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5	42	3.7	42	3.8	41	3.5
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
905	43	3.4	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5	42	3.6	42	3.7
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
920	43	3.3	43	3.4	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3
	44	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5	42	3.6
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
935	43	3.2	43	3.3	43	3.4	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2
	44	3.7	44	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
950	44	3.6	43	3.2	43	3.3	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4
	—	—	44	3.7	44	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
965	44	3.4	44	3.6	43	3.2	43	3.3	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3
	—	—	—	—	44	3.7	44	3.8	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	-
980	44	3.3	44	3.5	44	3.6	43	3.2	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2
	—	—	—	—	—	—	44	3.7	44	3.8	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
995	44	3.2	44	3.4	44	3.5	44	3.6	43	3.3	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8
	—	—	—	—	—	—	—	—	44	3.7	44	3.8	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1010	45	3.8	44	3.3	44	3.4	44	3.5	43	3.2	43	3.3	43	3.4	43	3.5	43	3.6	43	3.7
	—	—	—	—	—	—	—	—	44	3.6	44	3.7	44	3.8	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1025	45	3.7	44	3.2	44	3.3	44	3.4	44	3.5	43	3.2	43	3.3	43	3.4	43	3.5	43	3.6
	—	—	45	3.8	—	—	—	—	—	—	44	3.6	44	3.7	44	3.8	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1040	45	3.6	45	3.7	44	3.2	44	3.3	44	3.4	44	3.5	43	3.2	43	3.3	43	3.4	43	3.5
	46	3.8	—	—	—	—	—	—	—	—	—	—	44	3.6	44	3.7	44	3.8	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1055	45	3.5	45	3.6	45	3.8	44	3.2	44	3.3	44	3.4	44	3.5	43	3.2	43	3.3	43	3.4
	46	3.7	46	3.8	—	—	—	—	—	—	—	—	—	—	44	3.6	44	3.7	44	3.8
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1070	45	3.4	45	3.5	45	3.7	45	3.8	44	3.2	44	3.3	44	3.4	44	3.5	43	3.2	43	3.3
	46	3.6	46	3.7	46	3.8	—	—	—	—	—	—	—	—	—	—	44	3.6	44	3.7
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1085	45	3.3	45	3.4	45	3.6	45	3.7	45	3.8	44	3.2	44	3.3	44	3.4	44	3.5	43	3.2
	46	3.5	46	3.6	46	3.7	—	—	—	—	—	—	—	—	—	—	—	—	44	3.6
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1100	45	3.2	45	3.3	45	3.5	45	3.6	45	3.7	45	3.8	44	3.2	44	3.3	44	3.4	44	3.5
	46	3.4	46	3.5	46	3.6	46	3.8	—	—	—	—	—	—	—	—	—	—	—	—
	47	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4. To operate furnace, follow procedures on the lighting instructions label on the furnace.
5. With furnace operating, set thermostat below room temperature and observe that the furnace goes off. Set thermostat above room temperature and observe that the furnace restarts.

ADJUSTMENTS

1. Set gas input rate.

   There are 2 methods of adjusting the gas input rate. The preferred method is by using Table 6 and following instructions in item a. The second is by clocking the gas meter and following instructions in item b.

   The gas valve regulator has been nominally set at 3.5-in. wc for natural gas. When adjusting input rate, do not set manifold pressure above 3.8-in. wc or below 3.2-in. wc.

   a. Check gas input rate using Table 6.

      (1.) Obtain average yearly heat value for local gas supply.

      (2.) Obtain average yearly specific gravity for local gas supply.

      (3.) Verify furnace model. Table 6 can only be used for model 58GFA Furnaces.

      (4.) Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

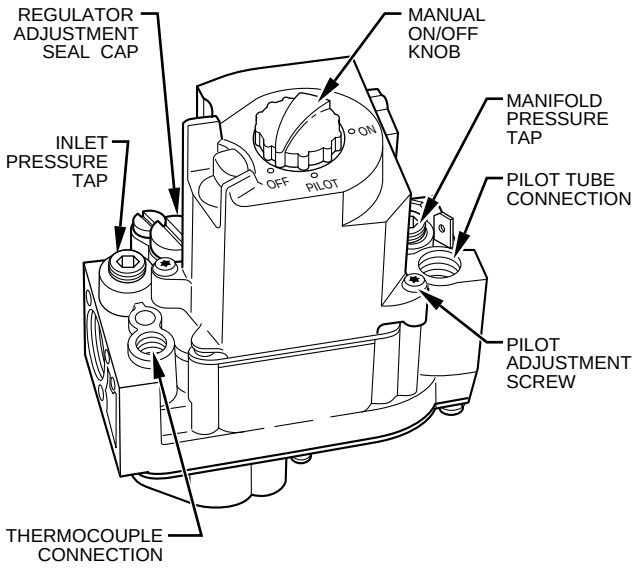

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Fig. 11—Redundant Automatic Gas Control Valve

⚠ CAUTION

DO NOT redrill burner orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of the burners and heat exchangers, causing failure.

NOTE: If orifice hole appears damaged or is suspected to have been redrilled, check the orifice hole with the correct size numbered drill bit. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.

(5.) Find natural gas heat value and specific gravity in Table 6.

(6.) Follow heat value and specific gravity lines to point of intersection. Find orifice size and manifold pressure settings for proper operation at given natural gas conditions.

EXAMPLE:
Heat value = 1070 Btu/cu ft
Btu/cu ft specific gravity = 0.58
Therefore; Orifice = No. 45 *
Manifold pressure = 3.7-in. wc
* The furnace is shipped with No. 44 orifices. Therefore, in this example all main burner orifices must be changed and manifold pressure must be adjusted.

(7.) Proceed to item c. to adjust manifold pressure.

b. Check gas input rate by clocking gas meter.

(1.) Obtain average yearly heat value for local gas supply.

NOTE: Be sure heating valve of gas used for calculations is correct for your altitude. Consult local gas utility for altitude adjustments of gas heating value.

(2.) Turn off all other gas appliances and pilots.

(3.) Start furnace and let run for 3 minutes.

(4.) Measure time (in sec) for gas meter to complete 1 revolution.

(5.) Refer to Table 7 for cu ft of gas per hr.

Table 7—Gas Rate Cu Ft/Hr

SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL 1 cu ft	2 cu ft	5 cu ft	SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL 1 cu ft	2 cu ft	5 cu ft
10	360	720	1800	50	72	144	360
11	327	655	1636	51	71	141	355
12	300	600	1500	52	69	138	346
13	277	555	1385	53	68	136	340
14	257	514	1286	54	67	133	333
15	240	480	1200	55	65	131	327
16	225	450	1125	56	64	129	321
17	212	424	1059	57	63	126	316
18	200	400	100	58	62	124	310
19	189	379	947	59	61	122	305
20	180	360	900	60	60	120	300
21	171	343	857	62	58	116	290
22	164	327	818	64	56	112	281
23	157	313	783	66	54	109	273
24	150	300	750	68	53	106	265
25	144	288	720	70	51	103	257
26	138	277	692	72	50	100	250
27	133	267	667	74	48	97	243
28	129	257	643	76	47	95	237
29	124	248	621	78	46	92	231
30	120	240	600	80	45	90	225
31	116	232	581	82	44	88	220
32	113	225	563	84	43	86	214
33	109	218	545	86	42	84	209
34	106	212	529	88	41	82	205
35	103	206	514	90	40	80	200
36	100	200	500	92	39	78	196
37	97	195	486	94	38	76	192
38	95	189	474	96	38	75	188
39	92	185	462	98	37	74	184
40	90	180	450	100	36	72	180
41	88	176	439	102	35	71	178
42	86	172	429	104	35	69	173
43	84	167	419	106	34	68	170
44	82	164	409	108	33	67	167
45	80	160	400	110	33	65	164
46	78	157	391	112	32	64	161
47	76	153	383	116	31	62	155
48	75	150	375	120	30	60	150
49	73	147	367				

Multiply gas rate (cu ft/hr) by heating value (Btu/cu ft).

EXAMPLE:
Btu heating input = Btu/cu ft X cu ft/hr
Heating value of gas = 1070 Btu/cu ft
Time for 1 revolution of 2 cu ft dial = 72 sec
Gas rate 100 X 1070 = 107,000 Btuh

(6.) Measured gas input should not exceed gas input on unit rating plate.

(7.) Proceed to item c. to adjust manifold pressure.

c. Adjust gas input.

(1.) Remove regulator adjustment seal cap. (See Fig. 11.)

(2.) Turn adjusting screw counterclockwise to decrease input. Turn screw clockwise to increase input. DO NOT set manifold pressure less than 3.2-in. wc or more than 3.8-in. wc for natural gas. Make any major adjustments by changing main burner orifices.

(1.) When correct input is obtained, replace regulator seal cap. Main burner flame should be clear blue, almost transparent. (See Fig. 12.)

d. High altitude—In the United States, gas input on rating plate is for altitudes up to 2000 ft. Ratings for altitudes over 2000 ft must be 4 percent less for each 1000 ft above sea level. To obtain the adjusted altitude rating, adjust the manifold pressure, item c., and replace the main burner orifices as needed. Refer to NFGC Appendix F Table F-4 for proper orifice sizing at high altitudes.

e. Canadian installations only—The Canadian ratings are approved for altitudes up to 2000 ft for natural and propane gases. High-altitude ratings are from 2001 ft to 4500 ft above sea level. High-altitude rating includes a 10 percent derate as required by Canadian standards. (See Table 8.)

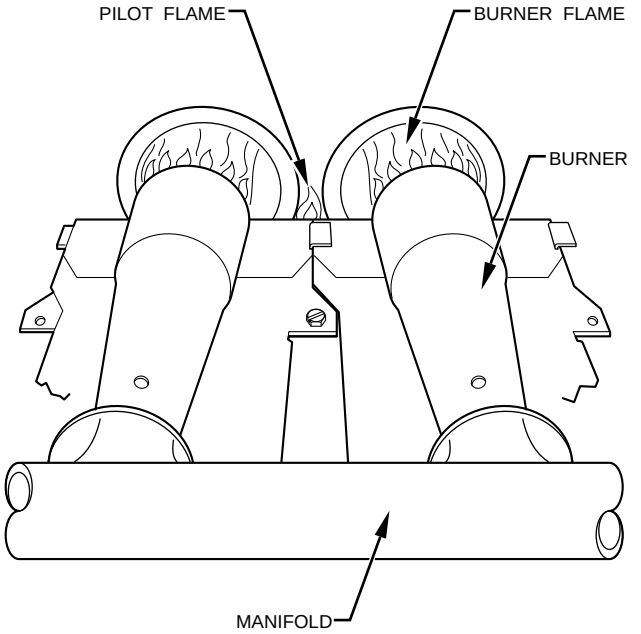

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Fig. 12—Burner Flame

Table 8—Canadian Orifice Size

GAS	SEA LEVEL 0—2000	HIGH ALTITUDE 2001—4500 FT
Natural	44	45
Propane	54	55

2. Set temperature rise.

   Do not exceed the temperature rise range specified on the unit rating plate. Determine the air temperature rise as follows:

   a. Place duct thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not "see" heat exchangers so that radiant heat will not affect thermometer readings. This is particularly important with straight-run ducts.

   b. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine temperature rise.

   c. Adjust air temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

   d. To change blower motor speed selections for heating mode, remove blower motor lead from control board HEAT terminal. (See Fig. 10) Select desired blower motor speed lead from 1 of the other terminals and relocate it to HEAT terminal. See Table 9 for lead color identification. Reconnect original lead on SPARE terminal.

⚠ WARNING

Disconnect the electrical power before changing the speed tap. Failure to follow this warning can cause personal injury.

→ **Table 9—Speed Selector**

COLOR	SPEED	FACTORY ATTACHED TO
Black	High	Cool
Yellow (When present)	Medium-High	Spare
Blue	Medium-Low	Heat
Red	Low	Spare
White	Common	COM

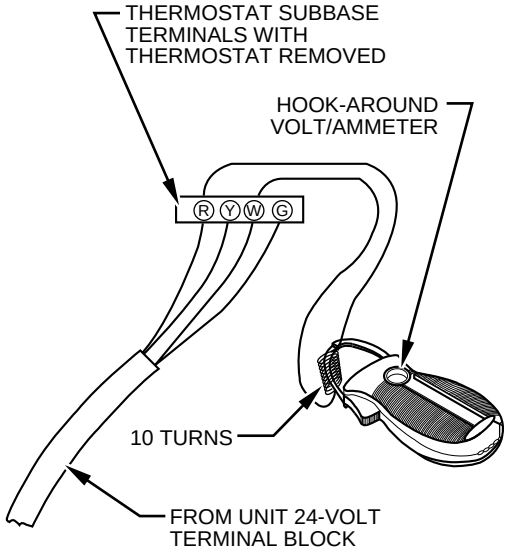
⚠ CAUTION

Recheck the temperature rise. It must be within the limits specified on the unit rating plate. Recommended operation at midpoint of rise or above.

3. Set thermostat heat anticipator.

   The thermostat heat anticipator must be set to match the amp draw of the electrical components in the R-W circuit. Accurate amp draw readings can be obtained at thermostat subbase terminals R and W. Fig. 13 illustrates an easy method of obtaining the actual amp draw. The amp reading should be taken after the blower motor has started. See the thermostat manufacturer's instructions for adjusting the heat anticipator and for varying the heating cycle length.

NOTE: When using an electronic thermostat, set the cycle rate for 3 cycles per hr.



EXAMPLE: $\frac{\text{5.0 AMPS ON AMMETER}}{\text{10 TURNS AROUND JAWS}}$ = 0.5 AMPS FOR THERMOSTAT SETTING

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Fig. 13—Amp Draw Check With Ammeter

CHECK SAFETY CONTROLS

1. Check operation of gas shut-off control for 100 percent shutoff.

NOTE: The furnace pilot must be lit to cause the thermocouple to energize the thermal magnet circuit of gas valve GV, which permits gas flow to the remaining portion of the valve. If the pilot flame is extinguished, the thermocouple will no longer energize the thermal magnet circuit of the gas valve GV. Gas flow to the pilot and the main burners will cease until the pilot is manually relit.

   a. With furnace operating, unscrew pilot thermocouple lead from gas valve. The pilot and main burner gas must shut off. No gas should flow through valve.

b. After valve is found to operate satisfactorily, reconnect thermocouple to gas valve (finger-tight position only).

c. Tighten thermocouple connection 1/4-turn with a wrench.

d. Relight the pilot following lighting instructions on furnace.

2. Check primary limit control.

   This control shuts off the combustion control system and energizes the circulating-air blower motor if the furnace overheats.

   The preferred method of checking the limit control is to gradually block off the return air after the furnace has been operating for a period of at least 5 minutes. As soon as the limit has shut off the burners, the return-air opening should be unblocked. By using this method to check the limit control, it can be established that the limit is functioning properly and will operate if there is a motor failure.

3. Check draft safeguard switch.

   The purpose of this control is to permit the safe shutdown of the furnace during certain blocked vent conditions.

   a. Disconnect power to furnace and remove vent connector from furnace outlet collar. Be sure to allow time for vent pipe to cool down before removing.

   b. Set room thermostat above room temperature and restore power to furnace.

   c. After normal start-up, allow furnace to operate for 2 minutes, then block 50 percent of flue outlet. Furnace should cycle off within 3 minutes.

   d. Remove blockage and reconnect vent pipe to furnace outlet collar.

   e. Wait 5 minutes and then reset draft safeguard switch.

4. Check pressure switch.

   This control proves operation of draft inducer blower.

   a. Turn off 115-v power to furnace.

   b. Remove control door and disconnect inducer motor lead wires from wire harness.

   c. Turn on 115-v power to furnace.

   d. Close thermostat switch as if making normal furnace start. If the burners do not light, the pressure switch is functioning properly.

   e. Turn off 115-v power to furnace.

   f. Reconnect inducer motor wires, replace control door, and turn on 115-v power.

CHECKLIST

1. Put away tools and instruments, and clean up debris.
2. Verify manual reset switches have continuity.
3. Ensure blower and control access doors are properly installed.
4. Cycletest furnace with room thermostat.
5. Check operation of accessories per manufacturer's instructions.
6. Review User's Manual with owner.
7. Leave literature packet near furnace.

SERVICE TRAINING

Packaged Service Training programs are an excellent way to increase your knowledge of the equipment discussed in this manual, including:

- Unit Familiarization
- Maintenance
- Installation Overview
- Operating Sequence

A large selection of product, theory, and skills programs is available, using popular video-based formats and materials. All include video and/or slides, plus companion book.

Classroom Service Training plus "hands-on" the products in our labs can mean increased confidence that really pays dividends in faster troubleshooting, fewer callbacks. Course descriptions and schedules are in our catalog.

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